

CLAIMS

1 1. A switch element comprising:
2 a plurality of input interfaces to receive data;
3 a plurality of output interfaces to transmit said data; and
4 a buffer to couple to said plurality of input interfaces and to said plurality of
5 output interfaces, the buffer including a multi-dimensional array of output queues to
6 store said data, wherein said multi-dimensional array of output queues is shared by said
7 plurality of output interfaces.

1 2. The switch element of claim 1, wherein said multi-dimensional array of
2 output queues comprise a three-dimensional array of output queues.

1 ~~Sub. A. The switch element of claim 2, wherein said three-dimensions comprise:~~
2 ~~a) a first dimension relating to a number of outputs on said switch~~
3 ~~element;~~
4 ~~b) a second dimension relating to a number of logical paths for said data;~~
5 ~~and~~
6 ~~c) a third dimension relating to a number of outputs from a next switch~~
7 ~~element.~~

1 4. The switch element of claim 3, wherein said logical paths are assigned
2 priority levels.

1 5. The switch element of claim 1, wherein said multi-dimensional array of
2 output queues share space of said buffer.

1 6. The switch element of claim 1, further comprising a plurality of virtual
2 input queues, wherein each virtual input queue represents a portion of said buffer.

1 7. The switch element of claim 1, further comprising an arbiter to select
2 data for transmission of said data to a downstream element.

1 8. The switch element of claim 7, wherein said arbiter selects said data
2 based on status information at said switch element.

1 Sub
2 App. The switch element of claim 8, wherein a queue status monitor
3 transmits a feedback signal from said switch element to a plurality of upstream switch
4 elements, said feedback signal comprising status information of output queues of said
 switch element.

1 10. The switch element of claim 8, wherein said arbiter selects said data by
2 utilizing transmit pressure information.

1 ~~11.~~ A switch fabric network for transmitting data, said network comprising:
2 a first switch element; and
3 a second switch element coupled to said first switch element, said second
4 switch element comprising:

5 a plurality of input interfaces to receive data from at least said first
6 switch element;
7 a plurality of output interfaces to transmit said data; and
8 a buffer to couple to said plurality of input interfaces and to said
9 plurality of output interfaces, the buffer including a multi-dimensional array of output
10 queues to store said data, wherein said multi-dimensional array of output queues is
11 shared by said plurality of output interfaces.

1 12. The switch fabric network of claim 11, wherein said multi-dimensional
2 array of output queues comprise a three-dimensional array of output queues.

1 13. The switch fabric network of claim 11, said second switch element
2 further comprising a plurality of virtual input queues, wherein each virtual input queue
3 represents a portion of said buffer.

1 ~~Sub 13~~ The switch fabric network of claim 11, said second switch element
2 further comprising an arbiter to select data for transmission of said data to a
3 downstream switch element.

1 15. The switch fabric network of claim 14, wherein said arbiter selects said
2 data by utilizing transmit pressure information.

1 ~~16.~~ A method of using a switch element in a switch fabric network, said
2 method comprising:
3 receiving data at an input interface of said switch element;
4 routing said data to one of a multi-dimensional array of output queues provided
5 within a buffer of said switch element; and
6 outputting said data from a selected one of said output queues.

1 17. The method of claim 16, wherein said multi-dimensional array of output
2 queues comprise a three-dimensional arrays of output queues.

1 ~~18.~~ The method of claim 17, wherein said three-dimensions comprise:
2 a) a dimension relating to a number of outputs on said switch element;
3 b) a dimension relating to a number of logical paths for said data; and
4 c) a dimension relating to a number of outputs from a next switch element.

1 19. The method of claim 16, wherein said switch element comprises a
2 plurality of virtual input queues, wherein each virtual input queue represents a portion
3 of said buffer.

1 20. The method of claim 16, further comprising selecting said data in one of
2 said output queues prior to said outputting.

1 21. The method of claim 20, wherein said data is selected based on status
2 information at said switch element.

1 22. The method of claim 20, wherein said data is selected by utilizing
2 transmit pressure information.

1 ~~23.~~ The method of claim 16, further comprising transmitting a feedback
2 ~~signal from said switch element to a plurality of upstream switch elements, said~~
3 ~~feedback signal comprising status information of output queues of said switch element.~~

1 ~~24.~~ A switch element comprising:
2 a buffer including a multi-dimensional array of output queues to store data; and
3 an arbiter to select one of said output queues for transmission of data, and a
4 queue status monitor to track the statuses of said multi-dimensional array of said
5 output queues.

1 ~~Sub 25~~ The switch element of claim 24, wherein said arbiter selects said one of
2 said output queues based on information of said switch element and information of a
3 next switch element.

1 26. The switch element of claim 25, wherein said arbiter further selects said
2 one of said output queues based on transmit pressure information.

1 27. The switch element of claim 24, wherein said multi-dimensional array of
2 output queues comprises three-dimensional output queues.

1 ~~Sub 28~~ The switch element of claim 27, wherein said three-dimensions
2 comprise:
3 a) a first dimension relating to a number of outputs on said switch
4 element;
5 b) a second dimension relating to a number of logical paths; and
6 c) a third dimension relating to a number of outputs from a next switch
7 element.

1 29. The switch element of claim 24, further comprising a plurality of virtual
2 input queues, wherein each virtual input queue represents a portion of said buffer.

1 30. The switch element of claim 24, wherein said arbiter selects said one of
2 said output queues based on status information at said switch element.

1 ~~Sub 31~~ The switch element of claim 24, wherein said queue status monitor
2 transmits a feedback signal from said switch element to a plurality of upstream switch
3 elements, said feedback signal comprising status information of output queues of said
4 switch element.

1 ~~32~~ A method of communicating information in a switch element, said
2 method comprising:
3 receiving data at said switch element;
4 storing said data in one queue of a multi-dimensional array of output queues in
5 a buffer of said switch element; and
6 selecting one of said output queues for transmission of data.

1 ~~Sub 33~~ The method of claim 32, wherein selecting said one of said output
2 queues comprises selecting based on information of said switch element and
3 information of a next switch element.

1 34. The method of claim 33, wherein said selecting is further based on
2 transmit pressure information.

1 35. The method of claim 32, wherein said multi-dimensional array of output
2 queues comprises a three-dimensional array of output queues.

1 ~~Sub 36. The method of claim 35, wherein said three-dimensions comprise:~~
2 ~~a) a first dimension relating to a number of outputs on said switch~~
3 ~~element;~~
4 ~~b) a second dimension relating to a number of logical paths for said data;~~
5 ~~and~~
6 ~~c) a third dimension relating to a number of outputs from a next switch~~
7 ~~element.~~

1 37. The method of claim 32, wherein said switch element includes a
2 plurality of virtual input queues, wherein each virtual input queue represents a portion
3 of said buffer.

1 ~~Sub 38. The method of claim 32, further comprising transmitting a feedback~~
2 ~~signal from said switch element to a plurality of upstream switch elements, said~~
3 ~~feedback signal comprising status information of output queues of said switch element.~~

1 ~~39. A switch comprising:~~
2 ~~a first output interface associated with a first output link;~~
3 ~~a first queue associated with said first output interface; and~~

4 a first arbiter associated with said first output interface and said first queue,
5 wherein said first arbiter schedules a next data packet for transmission from said first
6 output interface based on one of a pressure function and a local path priority.

1 40. The switch of claim 39, wherein said first arbiter schedules said next data
2 packet for transmission from said first output interface based on both said pressure
3 function and said local path priority.

1 ~~Sub A10~~ 41. The switch of claim 40, wherein said first arbiter schedules said next data
2 packet based on calculated transmit priorities of target queues in a downstream switch.

1 42. The switch of claim 41, wherein said first arbiter schedules said next data
2 packet relating to a target queue having a highest calculated transmit priority.

1 43. The switch of claim 39, further comprising a second output interface
2 associated with a second output link, a second output queue associated with said
3 second output interface, and a second arbiter to schedule a next data packet for
4 transmission from said second output interface.

1 ~~Sub A12~~ 44. The switch of claim 39, wherein said pressure function relates to a
2 relationship of data in said switch and data in a downstream switch.

1 45. A method of scheduling data traffic from a switch, said method
2 comprising:
3 determining a transmit priority based on one of a pressure function and a local
4 path priority; and
5 scheduling data traffic based on said determined transmit priority.

1 46. The method of claim 45, wherein said determining is based on both said
2 pressure function and said local path priority.

1 *Sub 47* 47. The method of claim 45, wherein transmit priority is further determined
2 based on information of target queues in a downstream switch.

1 48. The method of claim 47, wherein said scheduling comprises selecting a
2 target queue of said downstream switch having a highest calculated transmit priority.

1 49. The method of claim 45, wherein said pressure function relates to a
2 relationship of data in said switch and data in a downstream switch.